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1-17-03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BOARD OF PATENT APPEALS AND INTERFERENCES

In re patent application of

Lu et al.

Serial No.: 09/296,588 **Group Art Unit:** 2871

Filed: April 23, 1999 **Examiner:** Qi Zhi Qian.

For: METHODS OF REDUCING UNBALANCED DC VOLTAGE BETWEEN TWO ELECTRODES OF REFLECTIVE LIQUID DISPLAY BY THIN FILM PASSIVATION

Assistant Commissioner for Patents
Washington, D.C. 20231

APPELLANT'S APPEAL BRIEF

Sirs:

Appellants respectfully appeal the final rejection of claims 1-20 in the final Office Action dated July 12, 2002. A Notice of Appeal was timely filed on October 4, 2002.

I. REAL PARTY IN INTEREST

The real party in interest is International Business Machines Corp., Armonk, New York, assignee of 100% interest of the above-referenced patent application.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellant's legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-20 are all the claims pending in the application and are set forth fully in the attached appendix. Claims 1-20 were originally filed in the application. In response to an Office Action dated February 14, 2002, Appellants amended independent claims 1, 8, and 15 in an Amendment under 37 CFR 1.111 filed on May 10, 2002. A final Office Action dated July 12, 2002 stated that claims 1-20 were rejected on prior art grounds; and that claims 1-20 were also rejected under the doctrine of obviousness-type double patenting over claims 6-13 of "Lu". The claims were not amended in response to the July 12, 2002 final Office Action. Therefore, the claims in the attached Appendix are as amended by the May 10, 2002 Amendment.

IV. STATEMENT OF AFTER-FINAL AMENDMENTS

Appellants filed a Response Under 37 CFR 1.116 on September 12, 2002. This response did not make any claim amendments. An Advisory Action dated September 30, 2002 indicated that the Request for Reconsideration did not place the application in condition for allowance. The claims shown in the appendix are shown in their amended form as of the May 10, 2002 Amendment.

V. SUMMARY OF THE INVENTION

The invention uses a conducting amorphous film (carbon film or diamond-like carbon film) 35 to passivate both the electrode 38 and the pixel electrode 32 of a reflective-type AMLCD shown in Figure 5A which makes the Vcom shift uniformly small across the display panel and stable over time under different operating conditions. Claims 1 and 15 define this layer as "a conducting amorphous layer" and claim 8 defines this layer as "a conducting diamond-like amorphous carbon layer." The Office Action argues that any material has conductivity and uses such reasoning to conclude that an insulator layer in one of the prior art references has "slight" conductivity and, therefore, teaches the claimed conducting amorphous layer. Appellants strongly disagree.

With the inventive DLC layer 35, the Vcom shift is small and stable so that the display

can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker. Further, the invention has lower power consumption because the display is driven with frame-inversion at low frequencies which allows lower voltage drivers to be used for the display. Because the voltage drop across the DLC film is much lower than that of PI film, low-cost CMOS processes for active substrates may be used. Also, with the invention, no extra mechanism is required to detect the Vcom shift in real time to provide feedback for the adjustment of Vcom voltage to minimize the flicker.

VI. ISSUES PRESENTED FOR REVIEW

The issues presented for review by the Board of Patents Appeals and Interferences are whether claims 1-3, 5, 7-10, 12, 14-17, and 19 are anticipated by Yasukawa (U.S. Patent No. 6,344,888) under 35 U.S.C. §102(e); whether claims 4, 11, and 18 are unpatentable over Yasukawa in view of Hanihara et al., hereinafter "Hanihara" (U.S. Patent No. 5,990,988) under 35 U.S.C. § 103(a); whether claims 6, 13, and 20 are unpatentable over Yasukawa in view of Appellant's admitted prior art under 103(a); and whether claims 1-20 are unpatentable over claims 6-13 of Lu et al., hereinafter "Lu" (U.S. Patent No. 5,764,324) under the judicially created doctrine of obviousness-type double patenting.

VII. GROUPING OF THE CLAIMS

As supported by the following arguments, the claims are each independently patentable and do not stand or fall together. More specifically, the dependent claims are patently distinct from the independent claims from which they depend because each dependent claim defines additional features which are not defined in the independent claims or which are defined more broadly in the independent claims. As discussed in greater detail below, the features defined by the dependent claims are not merely illustrations or examples but include patentable features which prevent the dependent claims from standing or falling with their associated independent claim.

VIII. ARGUMENT

A. The 102(e) Rejection of Independent Claims 1, 8, and 15 Based on Yasukawa

1. The Position in the Office Action

With respect to the rejection of independent claims 1, 8, and 15, the Office Action states that Yasukawa discloses (col. 15, lines 25-52; col.6, line 48 - col.7, line 52; Figs. 7 and 1) a reflective liquid crystal panel comprising a counter electrode (common electrode) composed of a transparent electrode (ITO) (33), i.e., a first-type electrode or a transmissive electrode; a reflective electrode (pixel electrode 14), i.e., a second-type electrode or a reflective electrode positioned opposite the transmissive electrode (the transmissive electrode is an opposite type of the reflective electrode); a liquid crystal material (37) between the transmissive electrode (33) and the reflective electrode (14); a passivation film (17) formed on the entire pixel electrode (14) which is adjacent the liquid crystal material; and that the passivation film (17) is composed of a silicon oxide film.

The Office Action declares that because the amorphous layer (or the amorphous carbon layer) comprises a silicon oxide. that Yasukawa discloses that an amorphous layer comprises silicon oxide film as the passivation film. The Office Action recites that Yasukawa indicates (col. 7. lines 20-23) that the use of a silicon oxide film as the passivation film (17) covering the pixel region prevents significant change in reflectance due to the variation of film thickness and the wavelength of the light. such that preventing the display flickers. On the other hand. the Office Action notes that any material has conductivity. The Office Action states that using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8, and 15 also have slight conductivity, so that the material also is a conducting (slight conductivity) material. The Office Action concludes that the diamond-like conductive film has a very slight conductivity. Therefore, the Office Action argues that the material using SiO_2 meets claims 1, 8 and 15.

2. The Yasukawa Reference

Yasukawa discloses a liquid crystal substrate in which a matrix of reflecting electrodes is formed. A transistor is formed corresponding to each reflective electrode and a voltage is applied to the reflective electrode through the transistor. A silicon oxide film having a thickness of 500 to 2,000 angstroms is used as a passivation film and the thickness is set to a value in response to the wavelength of the incident light to maintain a substantially constant reflectance.

3. Appellant's Response

Yasukawa does not teach or suggest the use of a diamond-like conductive film adjacent one or both of the electrodes in a reflective LCD device as in the claimed invention. Claims 1 and 15 define this layer as "a conducting amorphous layer" and claim 8 defines this layer as "a conducting diamond-like amorphous carbon layer." On page 3, second paragraph, the Office Action argues that any material has conductivity and uses such reasoning to conclude that the silicon oxide passivation film 17 in Yasukawa has "slight" conductivity and, therefore, teaches the claimed conducting amorphous layer. Appellants strongly disagree.

Yasukawa requires that an insulator (silicon oxide) be positioned as a passivating layer next to the electrodes. On pages 7 and 8, the Office Action argues that Yasukawa discloses the claimed invention by using a silicon oxide film 17. More specifically, the Office Action states that "any material has conductivity. Using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8 and 15 also have supplied conductivity, so that the material also is a conducting (slight cannot activity) material. The diamond-like conductive film has a very slight conductivity". In other words, the Office Action argues that the amorphous insulator 17 disclosed in Yasukawa teaches the "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8).

Appellants agree that claim language should be interpreted broadly during examination; however, such an interpretation cannot reach the point of being so broad as to contradict the clear

meaning of the term being interpreted. Here, the claims clearly define a "conducting" layer. Silicon oxide is an insulator, unless modified (as with carbon) so that it changes its insulating characteristics.

The Office Action urges that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Appellants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide (and silicon dioxide) are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon dioxide layer 17 as an insulator and calls the layer a "passivating layer". Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light. Therefore, not only is the Office Action urging a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference.

Further, the Office Action argues that silicon oxide has a "slight" amount of conductivity. However, this language is not included in the claims. To the contrary, the claims merely define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). The terminology "slightly conducting" is not used in the independent claims. Therefore, the position in the Office Action is additionally erroneous because it is reading limitations into the claims that are not there.

In addition, the Office Action proposes that since some of the dependent claims define the

conducting amorphous layer as including ("comprising") silicon dioxide that silicon dioxide should be considered a conductor. But, Appellants submit that this logic is flawed because of the legal meaning of the word "comprising". More specifically, the dependent claims define that the amorphous layer can "comprise" a number of substances, one of which is a silicon dioxide. This is legally interpreted to mean that one of the elements within the layer is silicon dioxide. This does not mean that the layer is exclusively silicon dioxide. Instead, if Appellants had intended such a meaning, they would have used more restrictive language such as "consisting of" or "consisting essentially of." The paragraph appearing on page, lines 10-15, explains that the silicon dioxide layer is changed from an insulator into a conductor using a form of carbon.

As shown above, Appellants respectfully submit that in attempting to broadly interpret the claim language and the teachings of the prior art, that the Office Action has exceeded what is permitted. More specifically, classifying the passivating layer of silicon dioxide in Yasukawa as a conductor exceeds the boundaries permitted on broad interpretation. The claims clearly and unambiguously define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). To the contrary, Yasukawa discloses a passivating layer 17, nothing more. Therefore, Yasukawa does not teach or suggest the claimed invention.

As explained in column 16, lines 51-59 of Yasukawa, the prior art requires a passivating insulator 17. This requirement to use an insulator 17 teaches away from the claimed invention which uses a "conducting amorphous" layer adjacent at least one of the electrodes. Therefore,

Appellants respectfully submit that independent claims 1, 8, and 15 are patentable over Yasukawa, and the Board is respectfully requested to remove the prior art rejection of independent claims 1, 8, or 15.

B. The 102(e) Rejection of Dependent Claims 2, 3, 5, 7, 9, 10, 12, 14, 16, 17, and 19 Based on Yasukawa

1. The Position in the Office Action

With respect to the rejection of claims 2, 3, 5, 7, 9, 10, 12, 14, 16, 17, and 19, the Office Action states that Yasukawa discloses (col. 15, lines 25-52; col.6, line 48 - col.7, line 52; Figs. 7 and 1) a reflective liquid crystal panel comprising a counter electrode (common electrode) composed of a transparent electrode (ITO) (33), i.e., a first-type electrode or a transmissive electrode; a reflective electrode (pixel electrode 14), i.e., a second-type electrode or a reflective electrode positioned opposite the transmissive electrode (the transmissive electrode is an opposite type of the reflective electrode); a liquid crystal material (37) between the transmissive electrode (33) and the reflective electrode (14); a passivation film (17) formed on the entire pixel electrode (14) which is adjacent the liquid crystal material; and that the passivation film (17) is composed of a silicon oxide film.

The Office Action declares that because the amorphous layer (or the amorphous carbon layer) comprises a silicon oxide, that Yasukawa discloses that an amorphous layer comprises silicon oxide film as the passivation film. The Office Action recites that Yasukawa indicates (col. 7, lines 20-23) that the use of a silicon oxide film as the passivation film (17) covering the pixel region prevents significant change in reflectance due to the variation of film thickness and the wavelength of the light, such that preventing the display flickers. On the other hand, the Office Action notes that any material has conductivity. The Office Action states that using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8, and 15 also have slight conductivity, so that the material also is a conducting (slight conductivity) material. The Office Action concludes that the diamond-like conductive film has a very slight conductivity Therefore, the Office Action concludes that the material using SiO_2 meets the claims 1, 8 and 15.

With respect to claims 5, 12 and 19, the Office Action declares that Yasukawa discloses (col. 7, lines 37-38) that a polyimide alignment film is formed on the entire passivation film (17), i.e., a polyimide layer is formed between the passivation film (as the amorphous layer) and the liquid crystal material.

2. Appellant's Response and Independent Patentability of the Dependent Claims

Dependent claims 2, 9, and 16 define transmissive-type and reflective-type electrodes. Yasukawa is argued to disclose such type of electrodes in the Office Action. However, as shown above. Yasukawa is deficient in teaching that one of these electrodes is a "conducting amorphous layer" (claims 1 and 15) or "conducting diamond-like amorphous carbon layer" (claim8). Contrary to such conductive layers, the reference actually teaches a passivating layer. Therefore, Appellants submit that the prior art of record does not teach or suggest using such a conductive amorphous layer as a transmissive-type or reflective-type electrode and that dependent claims 2, 9, and 16 are not anticipated by Yasukawa and that the concept of using a conducting amorphous layer for the transmissive-type or reflective-type electrode is a concept that is independently patentable.

Dependent claims 3, 10, and 17 explicitly define subcomponents that make up the conducting amorphous layer defined in independent claims 1, 8, and 15. As shown above, Yasukawa does not teach such a conducting amorphous layer. Therefore, Yasukawa cannot teach the components that make up such a layer. Further, such components are not shown as being conventionally used as a conducting amorphous layer in a display as in the claimed invention. Thus, appellants submit that dependent claims 3, 10, and 17 are independently patentable over the prior of record.

Dependent claims 5, 12, and 19 define a specific layer between the conducting amorphous layer and the liquid crystal material defined by independent claims 1, 8, and 15. Once again, since Yasukawa does not teach such a conducting amorphous layer, it cannot teach a structure that includes various materials between the conducting amorphous layer and the liquid crystal material. Similarly, given this deficiency, the prior art of record does not teach or suggest the use of such liquid crystal material. Thus, dependent claims 5, 12, and 19 are not anticipated by Yasukawa and are independently patentable over prior art of record.

Dependent claims 7 and 14 define that the amorphous layer comprises a passivating layer. This again highlights the distinction between the claimed invention and the Yasukawa reference. More specifically, Yasukawa clearly defines a silicon oxide passivation film 17 (column 7, lines 9-10), while the claimed invention utilizes the conducting amorphous layer as the passivating layer. The invention defines a "conducting" material while the references defines an insulating material. Therefore, for the reasons shown above, dependent claims 7 and 14 are not anticipated by Yasukawa and are independently patentable over the prior of record.

In view of the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

C. The 103(a) Rejection of Dependent Claims 4, 11, and 18 Based on Yasukawa in View of Hanihara

1. The Position in the Office Action

With respect to claims 4, 11, and 18, the Office Action states that it was known that the silicon oxide film can be an alignment film. The Office Action argues that Hanihara discloses (col.5, lines 52-53) that an alignment film (8) made of silicon oxide is formed on the electrode (7), such that the silicon oxide film has a function to be an alignment film. The Office Action declares that because the amorphous layer comprises silicon oxide, that the amorphous layer made of silicon oxide has a unidirectional orientation matched to the liquid crystal material. Therefore, the Office Action concludes that an alignment film as claimed in claims 4, 11 and 18 would have been at least obvious.

2. The Hanihara Reference

Hanihara discloses a liquid crystal display device that has a semiconductor substrate. A plurality of switching elements are arranged on the substrate in a matrix, and a plurality of pixel electrodes are provided above the switching elements and arranged in a matrix corresponding to the switching elements. A liquid crystal layer is provided on the pixel electrodes. The switching

element is connected with a corresponding pixel electrode by a wiring layer. Dummy layers are provided in the same level as the wiring layer so that a surface of the dummy layer is substantially flush with a surface of the wiring layer.

3. Appellant's Response and Independent Patentability of the Dependent Claims

Hanihara does not cure the deficiency of Yasukawa shown above. More specifically, Hanihara does not teach or suggest the conductive amorphous layer defined by independent claims 1, 8, and 15. Indeed, Hanihara is only referenced for showing that silicon oxide has a unidirectional orientation matched to the liquid crystal material and is not intended to teach or suggest a diamond-like conductive amorphous layer. Therefore, any combination of Hanihara and Yasukawa would not teach or suggest "a conducting amorphous layer adjacent said liquid crystal material"; "a conducting amorphous diamond-like carbon layer adjacent said liquid crystal material"; or "forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively.

Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa and Hanihara. Dependent claims 4, 11, and 18 explicitly defined subcomponents that make up the conducting amorphous layer defined in independent claims 1, 8, and 15. As shown

above, Yasukawa does not teach such a conducting amorphous layer. Therefore, Yasukawa (even if combined with Hanihara) cannot teach the components that make up such a layer. Further, such components are not shown as being conventionally used as a conducting amorphous layer in a display as in the claimed invention. Thus, Appellants submit that dependent claims 4, 11, and 18 are independently patentable over the prior of record. In view of the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

D. The Rejection of Dependent claims 6, 13, and 20 Based on Yasukawa in View of Admitted Prior Art (APA)

1. The Position in the Office Action

With respect to claims 6, 13, and 20, the Office Action states that it was known that the voltage between the pixel electrode and the common electrode varies the transparency of the liquid crystal material. The Office Action argues that Appellant's admitted prior art discloses (col. 3, lines 1-4 in the specification) that varying the voltage to the electrode (106) (the pixel electrode) controls the liquid crystal cell (111) such that different amounts of light are transmitted across the liquid crystal display (different transparency of liquid crystal material), thus resulting in the display of a gray scale of light. Therefore, the Office Action concludes that a

voltage between the transmissive electrode and the reflective electrode varies the transparency of the liquid crystal material as claimed in claims 6, 13, and 20 would have been at least obvious.

2. Appellants' Response and Independent Patentability of the Dependent Claims

Neither the APA nor Yasukawa teach or suggest the conductive amorphous layer defined by independent claims 1, 8, and 15. The APA (Figure 1, page 2, line 18-page 3, line 10 of the specification) teaches that when a voltage below a threshold voltage is applied to the gate line 107, the transistor 109 is in an off-condition so that the potential on the data bus line 108 and electrode 106 are isolated from one another. When a voltage larger than the threshold voltage is applied on the gate bus line 107, the transistor 109 is in an on-condition (low impedance state), thereby allowing the voltage on the data bus line 108 to charge the electrode 106. Varying the voltage to the electrode 106 controls the liquid crystal cell 111 such that different amounts of light are transmitted across the liquid crystal display, thus resulting in the display of a gray scale of light. A reflective-type AMLCD is similar in structure to the transmissive-type AMLCD; however, the transparent electrode 106 is usually replaced with a reflective metal electrode which generally occupies a larger area to cover the transistor 109.

As shown above, the claimed invention is fundamentally different than any of the teachings in the prior art. The invention avoids flicker LCD problems by using a conducting thin

film, e.g., diamond-like carbon (DLC) film, coated on both the Al and ITO electrodes of reflective LCDs to reduce and stabilize the Vcom shift. The conducting film allows electrical charges to flow toward the electrodes and bend the Fermi level of the adjacent electrode and balance the surface potential. Thus, with the invention, the Vcom shift is small and stable so that the display can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker.

Such features are simply not taught or suggested by the prior art of record. More specifically, none of the applied references teaches or suggests "a conducting amorphous layer adjacent said liquid crystal material"; "a conducting amorphous diamond-like carbon layer adjacent said liquid crystal material"; and "forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively.

Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa and the APA. Dependent claims 6, 13, and 20 define that the voltage between the first-type and reflective electrodes controls the transparency of the liquid crystal material. As shown above, Yasukawa is deficient in teaching that one of these electrodes is a "conducting amorphous layer" (claims 1 and 15) or "conducting diamond-like amorphous carbon layer" (claim 8). Contrary to such conductive layers, the prior art actually teaches a passivating layer. Therefore, Appellants submit that the prior art of record does not teach or suggest using such a conductive amorphous layer to control the transparency of the liquid crystal material as defined

by dependent claims 6, 13, and 20. Therefore, dependent claims 6, 13, and 20 are patentable over the prior art of record. The concept of using a conducting amorphous layer to control the transparency of the liquid crystal material is a concept that is independently patentable. In view of the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

E. The Double Patenting Rejection of Claims 1-20 Based on Lu

1. The Position in the Office Action

The Office Action states that claims 1-20 are rejected under the judicially created doctrine of obviousness type double patenting as being unpatentable over claims 6-13 of U.S. Patent No. 5,764,324 (Lu). The Office Action argues that although the conflicting claims are not identical, they are not patentably distinct from each. The Office Action states that claims 1-20 of the application and the claims 6-13 of the U.S. Patent No. 5,764,324, except for a few wording differences, are substantially the same.

The Office Action recites that the claims 1-20 of the application claim a reflective-type liquid crystal display comprising a transmissive electrode; a reflective electrode; and a liquid crystal material between the transmissive electrode and the reflective electrode; where at least one of the transmissive electrode and the reflective electrode includes an amorphous layer (or amorphous carbon layer) adjacent the liquid crystal material, and that the amorphous (or

amorphous carbon layer) comprises a silicon oxide (SiO_2).

The Office Action further contends that claims 6-13 of Lu also have such limitations as a liquid crystal cell for a liquid crystal display device comprising a transparent electrode; a reflective electrode; and a liquid crystal material disposed between the transparent electrode and the reflective electrode; and at least one layer of dielectric material disposed between a transparent conductive layer and a reflecting metal layer, and the dielectric material comprises silicon dioxide, such that a silicon oxide film as a passivation film covering the pixel electrode.

2. The Lu Reference

Lu discloses a reflective liquid crystal cell for AMLCDs, wherein the reflective electrode may be passivated with an insulating film such as silicon oxide. In addition, the liquid crystal cell may include a conducting transparent electrode that has a work function substantially equal to the work function of the reflective electrode in the cell. The reflective electrode may include a transparent conductive layer such as ITO, or may include an integer number of film pairs, wherein the film pair comprises a first dielectric film having a low index of refraction and a second dielectric film having a high index of refraction.

3. Appellant's Response

Lu affirmatively claims a "dielectric material" adjacent the reflective electrode (claim 6). As shown above this teaches away from the invention that uses a "conductive" amorphous layer adjacent at least one of the electrodes. Therefore, there is a substantial difference between the claimed invention in Lu and the present invention. More specifically, the present invention which claims "a conducting amorphous diamond-like layer adjacent said liquid crystal material"; "conducting amorphous carbon layer adjacent said liquid crystal material"; and "forming a diamond-like conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively, is patentably distinct (and patentable over) the invention defined by claims 6-13 of Lu. In view the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

IX. CONCLUSION

The invention uses a conducting amorphous film (carbon film or diamond-like carbon film) 35 to passivate both the electrode 38 and the pixel electrode 32 of a reflective-type AMLCD shown in Figure 5A which makes the Vcom shift uniformly small across the display panel and stable over time under different operating conditions. Claims 1 and 15 define this

layer as "a conducting amorphous layer" and claim 8 defines this layer as "a conducting diamond-like amorphous carbon layer." The Office Action argues that any material has conductivity and uses such reasoning to conclude that an insulator layer in one of the prior art references has "slight" conductivity and, therefore, teaches the claimed conducting amorphous layer. Appellants strongly disagree.

Appellants agree that claim language should be interpreted broadly during examination; however, such an interpretation cannot reach the point of being so broad as to contradict the clear meaning of the term being interpreted. Here, the claims clearly define a "conducting" layer. Silicon oxide is an insulator, unless modified (as with carbon) so that it changes its insulating characteristics.

The Office Action urges that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Appellants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide (and silicon dioxide) are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon dioxide layer 17 as an insulator and calls the layer a "passivating layer". Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light. Therefore, not only is the Office Action urging a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference.

Further, the Office Action argues that silicon oxide has a "slight" amount of conductivity. However, this language is not included in the claims. To the contrary, the claims merely define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). The terminology "slightly conducting" is not used in the independent claims. Therefore, the position in the Office Action is additionally erroneous because it is reading limitations into the claims that are not there.

With the inventive DLC layer 35, the Vcom shift is small and stable so that the display can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker. Further, the invention has lower power consumption because the display is driven with frame-inversion at low frequencies which allows lower voltage drivers to be used for the display. Because the voltage drop across the DLC film is much lower than that of PI film, low-cost CMOS processes for active substrates may be used. Also, with the invention, no extra mechanism is required to detect the Vcom shift in real time to provide feedback for the adjustment of Vcom voltage to minimize the flicker.

Appellants respectfully submit that in attempting to broadly interpret the claim language and the teachings of the prior art, that the Office Action has exceeded what is permitted. More specifically, classifying the passivating layer of silicon dioxide in Yasukawa as a conductor exceeds the boundaries permitted on broad interpretation. The claims clearly and unambiguously define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). To the contrary, Yasukawa discloses a passivating layer 17, nothing

more. No other prior art of record is referenced in the Office Action for teaching this feature. In view the forgoing, the Board is respectfully requested to reconsider and withdraw the foregoing rejections.

Please charge any deficiencies and credit any overpayments to Attorney's deposit account number 50-0510.

Respectfully submitted,

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APPENDIX

1. A reflective-type liquid crystal display comprising:

a first-type electrode;

a second-type electrode positioned opposite said first-type electrode and being of an opposite type than said first-type electrode; and

a liquid crystal material between said first-type electrode and said second-type electrode,

wherein at least one of said first-type electrode and said second-type electrode includes a conducting amorphous layer adjacent said liquid crystal material.

2. The reflective-type liquid crystal display in claim 1, wherein said first-type electrode comprises a transmissive-type electrode and said second-type electrode comprises a reflective-type electrode.

3. The reflective-type liquid crystal display in claim 1, wherein said amorphous layer comprises one of a hydrogenated amorphous carbon silicon, germanium, SiO_2, Si_3N_4 and TiO_2.

4. The reflective-type liquid crystal display in claim 1, wherein said amorphous layer has a unidirectional orientation matched to said liquid crystal material.

5. The reflective-type liquid crystal display in claim 1, further comprising one of a polyimide layer, polyamide layer and oblique-evaporated inorganic layer between said amorphous layer and said liquid crystal material.

6. The reflective-type liquid crystal display in claim 1, wherein a voltage between said first-type electrode and said reflective electrode varies a transparency of said liquid crystal material.

7. The reflective-type liquid crystal display in claim 1, wherein said amorphous layer comprises a passivation layer.

8. A reflective-type liquid crystal display comprising:

a transmissive electrode;

a reflective electrode positioned opposite said transmissive electrode; and

a liquid crystal material between said transmissive electrode and said reflective electrode,

wherein at least one of said transmissive electrode and said reflective electrode includes a conducting diamond-like amorphous carbon layer adjacent said liquid crystal material.

9. The reflective-type liquid crystal display in claim 8, wherein said transmissive electrode comprises indium tin oxide and said reflective-type electrode comprises aluminum.

10. The reflective-type liquid crystal display in claim 8, wherein said amorphous carbon layer comprises one of a hydrogenated amorphous carbon silicon, germanium, SiO_2, Si_3N_4 and TiO_2.

11. The reflective-type liquid crystal display in claim 8, wherein said amorphous carbon layer has a unidirectional orientation matched to said liquid crystal material.

12. The reflective-type liquid crystal display in claim 8, further comprising one of a polyimide layer, polyamide layer and oblique-evaporated inorganic layer between said amorphous carbon layer and said liquid crystal material.

13. The reflective-type liquid crystal display in claim 8, wherein a voltage between said transmissive electrode and said reflective electrode varies a transparency of said liquid crystal material.

14. The reflective-type liquid crystal display in claim 8, wherein said amorphous carbon layer comprises a passivation layer.

15. A method of forming a reflective-type liquid crystal display comprising:

forming a first-type electrode;

forming a second-type electrode positioned opposite said first-type electrode and being of

an opposite type than said first-type electrode;

forming a liquid crystal material between said first-type electrode and said second-type electrode; and

forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material.

16. The method in claim 15, wherein said forming of said first-type electrode comprises forming a transmissive-type electrode and said forming of said second-type electrode comprises forming a reflective-type electrode.

17. The method in claim 15, wherein said forming of said amorphous layer comprises forming one of a hydrogenated amorphous carbon silicon, germanium, SiO_2, Si_3N_4 and TiO_2 layer.

18. The method in claim 15, wherein method includes forming said amorphous layer to have a unidirectional orientation matched to said liquid crystal material.

19. The method in claim 15, further comprising forming one of a polyimide layer, polyamide layer and oblique-evaporated inorganic layer between said amorphous layer and said liquid crystal material.

20. The method in claim 15, wherein a voltage between said first-type electrode and said reflective electrode varies a transparency of said liquid crystal material.